

DATE: April 20, 2007

TO: Region Engineers
Region Delivery Engineers
TSC Managers
Resident/Project Engineers
Region Construction Engineers
Region Materials Engineers

FROM: Larry E. Tibbits
Chief Operations Officer

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SUBJECT: Bureau of Highway Instructional Memorandum 2007-02
Bridge Construction and Bridge Deck Construction Inspection

This document clarifies the procedures for bridge construction and bridge deck construction inspection. It also provides requirements for sampling and testing of bridge concrete, documenting bridge steel reinforcement, wet and dry bridge decks concrete depth measurements, and documentation for bridge construction inspection. This document must be coordinated with the *2003 Standard Specifications for Construction*, Divisions 6 and 7 of the *Construction Manual*, and the *Materials Quality Assurance Procedures Manual*.

Documentation for Bridge Construction and Bridge Deck Construction Inspection

The resident/project/delivery engineer (hereinafter referred to as “engineer”) is responsible for performing all testing, inspection, and recording on the forms listed below. See Section 706 of the *2003 Standard Specifications for Construction* and the contract documents for the contractor’s responsibilities.

- Form 1138, Bridge Reinforcing Computations

The engineer must complete Form 1138, Bridge Reinforcing Computations, for all structural concrete pours prior to the commencement of the pour. The engineer shall verify and record bar type, size, number, length, calculate total length, weight per foot, calculate total weight and add any remarks (top mat, bottom mat, transverse, longitudinal, vertical, barrier, etc.).

- Form 1131, Bridge Decks Concrete Depth Measurements (required for bridge decks)

The engineer must complete Form 1131, Bridge Decks Concrete Depth Measurements, for all bridge deck pours. See Division 706 of the *Construction Manual* for a sample form and instructions. The engineer shall verify and record dry run and wet run depth

checks. Note the locations of dry run measurements and measure wet run at or near the same locations.

- Form 1125, Permit to Place

The engineer must complete Form 1125, Permit to Place, for all substructure and superstructure concrete pours including bridge barrier railings. Note the form has been revised to include substructure and superstructure concrete. Issue permit to place only after approval of forms, bracing, reinforcing steel, and preparations for casting concrete. This includes removing debris from the forms, cleaning forms and steel reinforcement. The contractor must also provide a minimum 12-hour burlap soak for wet cure for bridge decks, have appropriate weather equipment to determine relative humidity and wind speed for the evaporation rate for bridge deck pours, vibrators with rubber coated heads, and a ten foot straightedge for checking bridge deck trueness.

- Form 1174A, Inspector's Report of Concrete Placed

The engineer must complete Form 1174A, Inspector's Report of Concrete Placed, for all structural concrete pours. See Division 6 of the *Construction Manual* for instructions. Note the form has been revised to include "Aggregate Correction Factor" and "Evaporation Rate" under "Structure Items Placed." Use contractor-supplied weather equipment to determine and record the evaporation rate for bridge deck pours is less than 0.20 psf per hour per Figure 706-1 of the *2003 Standard Specifications for Construction*. Verify and record all concrete test results, cylinders tags, aggregate correction factor supplied from the concrete supplier, quantity of curing compound used, and structural concrete quantities on the form.

- Form 1122B, Inspector's Daily Report (IDR)

The engineer must complete Form 1122B, Inspector's Daily Report, for all bridge work. See the *Construction Manual* for instructions. The engineer shall record and verify permanent metal deck form information. The engineer must record, verify reinforcement storage, and verify repair to epoxy-coated reinforcement. The engineer must also verify the contractor has provided weather equipment to determine the evaporation rate.

- MDOT Bridge Deck Construction Inspection Checklist (attached)

This checklist is an aid for documentation and inspection of bridge deck construction. The checklist identifies important documentation items for testing and inspection, and items to observe during the bridge pour operations. The engineer shall complete the MDOT Bridge Deck Construction Inspection Checklist for all bridge decks.

Random Number

Following is the required procedure to be used to ensure the random sampling process is uniform, properly documented, and reproducible. See the *Materials Quality Assurance Procedures Manual* for more information.

1. Prior to the pre-pour meeting, generate random numbers using a computer spreadsheet program or a calculator. The random numbers will be used for the cubic yardage to determine samples based on the size of the pour. Generate an excess amount of random numbers to take into account overruns or any situation where another random number is required.
2. At the pre-pour meeting, present each page that lists random numbers (cover the numbers with a separate sheet of paper) for signature of the contractor and delivery engineer.
3. Place the original list in the project file; copies go to MDOT's field personnel.
4. Provide the list of random numbers to the contractor when the project is completed.

Bridge Construction and Bridge Deck Construction Inspection

Permanent Metal Deck Forms

The engineer shall record and verify the source of the permanent metal deck forms. The engineer shall verify the contractor is installing the forms as shown in the approved shop plan drawings. The engineer shall also verify the contractor has field drilled ¼ inch diameter weep holes in the forms at 12 inch maximum spacing along the transverse and longitudinal construction joints. See Section 707 of the *2003 Standard Specifications of Construction* regarding field welding and welder certifications. If using Styrofoam in corrugations, ensure it is secure so the concrete will not displace it.

Shear Developers

See Division 707 of the *Construction Manual* and Section 707 of *2003 Standard Specifications for Construction* for installing and testing procedures for shear developers.

Epoxy Coated Steel Reinforcement

The engineer shall ensure the contractor is storing the epoxy coated steel reinforcement per the *2003 Standard Specifications for Construction*, and covering the reinforcement to protect it from the sun's ultraviolet rays. The engineer shall also verify the contractor's repair of epoxy coating using a patching/repair material selected from Section 905.03.C, Bar Reinforcement (Epoxy Coating) of the qualified products list. Note the repair product on Form 1122B, Inspector's Daily Report. Complete Form 1138, Bridge Reinforcing Computations. Ensure reinforcement is placed as shown on the plans and provide clear cover according to the plans and specifications. Verify the contractor is placing bar chairs as required in the *2003 Standard Specifications for Construction*.

Bridge Deck Pour Sequence

The engineer shall verify the contractor is following the pour sequence as shown on the plans. Any changes to the sequence must be approved in writing by MDOT Bridge Design and noted in the project files. See Section 706.03.P. of the *2003 Standard Specifications for Construction* for instructions to remove vertical forms, including bulkheads at construction joints. Removal should not be done until at least 15 hours after the pour is completed.

Changing Night Casting of Bridge Decks

There are circumstances when proposed night casting of a bridge deck may be changed to day pours. Such circumstances occur primarily when the maximum daytime temperature does not exceed 60 degrees (F) and/or the nighttime temperatures are below 40 degrees (F). Consult the Bridge Construction staff in the Construction and Technology Division's Bridge Operations Section prior to revising night casting. The engineer must document the change in the project records. The following requirements must be followed:

1. The concrete mix design should not incorporate a retarding admixture.
2. Cold weather precautions are applied, as appropriate.
3. MDOT is credited for all cost savings from the appropriate pay items associated with the deletion for any portion of the night casting:
 - An adjustment to the cubic yard price for the item of "Superstructure Concrete, Night Casting" which was cast during the day (usually a reduction of two dollars per cubic yard).
 - Adjust the quantity for cubic yard for the item, "Bridge Lighting, Operate and Maintain," to that which was actually night cast.
 - Delete the item, "Bridge Lighting, Furnish and Remove" (delete only if all pours were cast during the day).
 - No adjustment for "Superstructure Concrete, Form, Finish, Cure, Night Casting" is required.

Concrete Quality Assurance and Quality Control

The engineer shall generate random numbers for quality assurance testing. The engineer shall also ensure the contractor is performing concrete yield tests as part of contractor's concrete quality control. Subtract the aggregate correction factor from the field air content test results. Perform sampling of the concrete according to Michigan Test Method 207 at the pump discharge unless it is correlated to the concrete delivery truck. Note the correlation on the IDR.

Placing Bridge Deck Concrete

Verify the concrete is falling less than 6 inches from the discharge chute to the uppermost steel reinforcement for bridge deck pours.

Finishing Bridge Deck Concrete

The engineer shall ensure the contractor verifies the bridge deck trueness with a 10 foot straightedge while the concrete is still plastic. The engineer will check the finished deck with a 10 foot straightedge and mark the defective areas prior to acceptance.

Texturing and Curing Bridge Decks

The engineer shall ensure the contractor textures the deck as soon as the concrete has set sufficiently to maintain the texture per the *2003 Standard Specifications for Construction*. The engineer shall also ensure the contractor applies a curing compound from the qualified product list at a rate not less than one gallon per 150 square feet of surface immediately after the sheen of bleed water has left the textured concrete surface. The engineer shall ensure the contractor wet

cures the bridge deck per the *2003 Standard Specifications for Construction*. The engineer shall ensure the contractor has soaked the burlap a minimum of 12 hours prior to beginning the deck pour, that the burlap is placed (excess water removed) as soon as the curing compound has dried sufficiently to prevent adhesion, and that the concrete will support it without deformation, but not more than two hours after the deck was cast. Do not use Burlene directly on the bridge deck concrete. The engineer shall ensure the contractor provides a network of soaker hoses and a system to apply cure water uniformly and continuously for at least 7 days, and that the entire deck surface is covered with a minimum 4 mil polyethylene film.

Concrete Delivery Tickets

The engineer shall verify and record discharge time on the tickets and sign all of the concrete delivery tickets.

Notification

Notify Eric Burns (517-322-6331) or Scott Hobner (517-322-5120) of the Construction and Technology Division's Bridge Operations Section one week prior to the commencement of the bridge deck pours.

Chief Operations Officer

Engineer of Delivery

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MDOT BRIDGE DECK CONSTRUCTION INSPECTION CHECKLIST

Control Section	Project No.	Date
Structure No.	Structure Location:	
Contractor:		Concrete Supplier:
Inspector:		Engineer:

A. Pre-Pour Meeting

Initials

- Contractor submitted Concrete QC/QA plan per subsection 701.03.F.1 _____
- Concrete Supplier and Contractor Concrete Testing Personnel identified _____
- Generate random numbers for concrete quality assurance sampling _____
- Approved Concrete Mix Design(s) submitted, including Aggregate Correction Factor _____
- Contractor to submit deck lighting scheme for approval _____
- Contractor to submit for approval of equipment to be used to determine relative humidity and wind velocity at site per subsection 706.03.H.2 _____

B. Prior to Pour

- Inspect forms and check for grade, straightness, tightness, and location _____
- Review approved stay-in-place forms and shop drawings prior to installation _____
- If using metal stay-in-place forms, ensure that Styrofoam is in the corrugations and secured (if required). Ensure ¼ inch weep holes are drilled 12 inches on center along transverse and longitudinal construction joints _____
- Ensure the epoxy coated steel reinforcement is properly stored and covered prior to placement to prevent damage from sunlight _____
- Inspect steel reinforcement, including bar chair location and spacing _____
- Verify bar size, quantity, location, spacing, clear cover laps, and ties of transverse, longitudinal and vertical steel reinforcement. Record quantities on *Form 1138, Bridge Reinforcing Computations* _____
- Repair epoxy coating resteel per subsection 706.03.E. 8. Verify product on the Qualified Product List per subsection 905.03. Record product on IDR _____
- Verify that quality assurance testing personnel are on site to perform verification testing _____
- Ensure the bulkheads for construction joints are in place, secure, and at the correct grade. Check contractor's grades and verify during the dry run. _____
- Ensure vibrators have rubber coated heads per subsection 706.03.H.1 _____
- Perform dry run per subsection 706.03.M.1 and record depth measurements on *Form 1131, Bridge Decks Concrete Depth Measurement*. Note locations. _____
- Ensure contractor furnishes a 10 foot straightedge per subsection 706.03.M.1 _____
- Ensure the burlap has been soaking a minimum of 12 hours before the pour, per subsection 706.03. N.b., and excess water has been removed. _____
- Ensure the equipment to determine relative humidity, temperature, and wind velocity is on site and working properly. Record evaporation rate on *Form 1174A, Inspector's Report of Concrete Placed* _____
- Ensure the equipment for applying curing compound is in working condition _____
- Ensure the bridge deck is free from debris per subsection 706.03.H.1 _____
- Issue *Form 1125, Permit to Place* _____

MDOT BRIDGE DECK CONSTRUCTION INSPECTION CHECKLIST

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C. <u>During the Pour</u>	<u>Initials</u>
<ul style="list-style-type: none">• Record Aggregate Correction Factor on <i>Form 1174A, Inspector's Report of Concrete Placed</i>	_____
<ul style="list-style-type: none">• Ensure contractor is performing QC and QA testing, including yield tests	_____
<ul style="list-style-type: none">• Complete <i>Form 1174A, Inspector's Report of Concrete Placed</i>	_____
<ul style="list-style-type: none">• Verify concrete delivery tickets match the concrete mix design	_____
<ul style="list-style-type: none">• Perform concrete QA verification testing	_____
<ul style="list-style-type: none">• Ensure engineer tags the quality assurance cylinders	_____
<ul style="list-style-type: none">• Test concrete at the pump discharge and correlate to testing at the concrete Truck, according to MTM 207	_____
<ul style="list-style-type: none">• Record elapsed time interval on every delivery ticket between charging the mixer and the placement of the concrete. Sign the concrete delivery tickets	_____
<ul style="list-style-type: none">• Vibrator with rubber coated heads being used within 15 minutes of placement	_____
<ul style="list-style-type: none">• Ensure contractor does not over vibrate or over finish the concrete	_____
<ul style="list-style-type: none">• Ensure concrete does not freefall more than 6 inches to the deck resteel	_____
<ul style="list-style-type: none">• Perform wet run and record measurements on <i>Form 1131, Bridge Decks Concrete Depth Measurement</i> near locations of the dry run	_____
<ul style="list-style-type: none">• Ensure contractor checks deck tolerance with a 10 foot straightedge both longitudinally and transversely	_____
<ul style="list-style-type: none">• Do not allow the contractor to apply water to the deck surface to aid in finishing. If necessary, allow only with an approved fog sprayer and only when approved by the engineer	_____
<ul style="list-style-type: none">• Inspect texturing per subsection 706.03.M.	_____
<ul style="list-style-type: none">• Verify the white curing compound was applied at the appropriate time and at the correct application rate	_____
<ul style="list-style-type: none">• Verify the wet cure (burlap, soaker hoses, polyethylene) was applied at the appropriate time	_____
<ul style="list-style-type: none">• Verify the low temperature protection was applied as necessary per 706.03.J2.b.	_____
D. <u>After the Deck Pour</u>	
<ul style="list-style-type: none">• Verify the wet cure is maintained for seven days. Check deck to verify soaker hoses are working	_____
<ul style="list-style-type: none">• Ensure that the contractor waits a minimum of 15 hours to strip bulkheads after completion of the pour	_____
<ul style="list-style-type: none">• Do not allow casting of sidewalks or railings until the deck concrete has met 7 day minimum flexural or compressive strength and after the 7 day wet cure	_____
<ul style="list-style-type: none">• Saw cut deck construction joints within 4 hours after removing wet cure	_____
<ul style="list-style-type: none">• Inspect deck tolerance 1/8 inch in 10 foot with 10 foot straightedge prior to acceptance	_____